

Revised Work Program JRG 1A-1C-8B

Background

Unwanted emission masks in the out-of-band domain for primary radar systems are contained in Recommendation ITU-R SM.1541, Annex 8. The ITU-R out-of-band emission masks for primary radars systems are intended to recommend an acceptable degree of electromagnetic compatibility among radar systems, and between such systems and those of other radio services sharing the frequency spectrum.

In the development of the out-of-band emission masks for primary radar systems, it was the view of several administrations that there was a need to further investigate the state-of-the-art radar systems and their ability to suppress unwanted emissions. This review of radar unwanted emissions in the out-of-band domain is to be completed by 2006. See Recommendation ITU-R SM.1541, Annex 8, Note 3. The outstanding issue concerns the “design objectives” highlighted in this document. This “design objective” concerns the possibility of making more stringent the requirement for radars with regard to the “roll-off” of out-of-band (OOB) emissions.

The outcome of this study may result in revisions to Recommendation ITU-R SM.1539, which addresses the boundary between the out-of-band and spurious domains, and Recommendation ITU-R SM.1541, which addresses out-of-band emissions domain.

Pursuant to initiating this study, Working Party 8B revised Question 202/8 to provide guidance to administrations in conducting their investigation.

Objectives

The objectives of this work programme are to:

- a) Review the current ITU-R limits for unwanted emissions in the out-of-band domain contained in Annex 8 of Recommendation ITU-R SM.1541, and assess the feasibility of establishing guidance to promote more effective and efficient use of the spectrum.

Approach

In order to accomplish the above objectives, the following tasks will be undertaken:

- a) Develop a software tool that will provide current ITU-R emission masks and alternative emission masks for comparison with measured radar emission data.
- b) Identify, through measurements, characteristic radar emission spectra considering such parameters as: waveforms (e.g. pulse shape and modulation); types of output devices; RF filter technologies; and antenna types.

- c) Analyse the measured emission characteristics to assess the feasibility of establishing more spectrum efficient emission masks.
- d) Discuss draft revised emission masks, and identify state-of-the-art capabilities which may allow radars to operate more efficiently while recognizing economic impacts and mission requirements to achieve efficient and effective operation.
- e) Report the results of these studies to Working Party 1A, 1C and 8B.

Milestones

Completion of the aforementioned approach should correspond to the following task milestone dates:

- a) February 2004 (version 2 provided)
Revisions to the program will be issued as appropriate.
- b) March 2005
- c) September 2005
- d) September 2005
- e) August 2006

Specific areas requiring studies

The following areas have been identified as key areas in which studies are necessary in order to assess the feasibility of the “design objective” of Recommendation ITU-R SM.1841, Annex 8.

1. Review the –20dB bandwidth (necessary bandwidth) and –40 dB bandwidth formulas for FM-pulsed modulated and FMCW waveforms, including non-linear FM applicable across a wide range of time-bandwidth products. Analysis and measurements have shown that the current formulas FM-pulsed modulated waveforms are generous for large time-bandwidth products (compression ratios) (See Documents JRG-12, JRG-13, JRG-19 and JRG-21). Analysis indicates that the current –40 dB bandwidth formula for FMCW modulated waveforms may not be representative for all cases (see Document JRG-7).
2. Determine if current formulas for the –20dB bandwidth (necessary bandwidth) and –40 dB bandwidth apply for waveforms such as stepped chirp, phase-coded pulses (MSK/GMSK, QPSK and Taylor quadriphase), step FM, multi-carrier radars and develop new formulas as appropriate.
3. Investigate the –40dB bandwidth formula for non-FM pulsed radars using magnetrons with low pulse width to rise time ratio (see documents JRG-7, JRG-16).
4. Identify through measurements the achievable roll-off from the –40 dB bandwidth for radars with solid state output devices as a function of the class of amplification.

5. Investigate the feasibility of implementing filters between solid state Transmit-Receive (T/R) Modules and the antenna elements. These studies should consider the type of platform (e.g. ground based, ship borne, airborne, space borne).
6. Review the definition of rise time (Note 1 of Annex 8 of Rec. ITU-R SM.1541).
7. Determine the characteristics of airborne radar systems.
8. For radars using magnetrons, acquire additional emission spectrum data, especially for S Band radars, and identify factors that could affect the emission spectrum (e.g. temperature).

Meeting dates / locations and aims

1. First quarter 2005 / United Kingdom
 - a) Further data to validate the “design objectives”
 - b) Outline final report
2. Third quarter 2005 / U.S.
 - a) Further structuring of final report
 - b) First proposed revision of Rec. ITU-R SM.1541
3. First quarter 2006 / Germany
 - a) Complete draft of final report
 - b) Finalize proposed revision of Rec. ITU-R SM.1541
4. Third quarter 2006 / Geneva
 - a) Agree on final report including proposed revision of Rec. ITU-R SM.1541